

Research Group of Durability and Structural Safety

Carmen Andrade

Institute of Construction Sciences “Eduardo Torroja”
CSIC-Spain



CSIC

17.319 Total personnel

12.863 Civil servants

126 Institutes

163 Associated Units

4.794 Researchers

6.660 Technicians

1.409 ADMINISTRATION



Calar Alto

**Oceanographic vessel
Hespérides**

CANARIAS

1



**Antarctic base
Juan Carlos I**

31/10/2012

INSTITUTE OF CONSTRUCTION SCIENCES “EDUARDO TORROJA”



DEPARTMENTS

Construction

Safety and Durability

Synthesis and recycling of materials

Research Groups

TECHNICAL SERVICES

National Building Code

Evaluation of Innovative systems

IETcc prepares all drafts of standards of **the Building Technical Code** issued by the Ministry of Public Works.

PUBLICATIONS

Materiales de Construcción

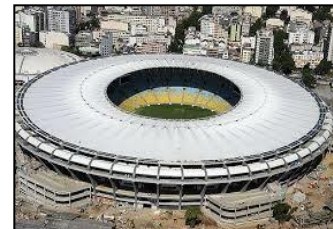
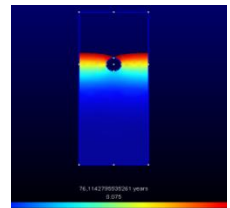
Informes de la Construcción

Presentation of the lines of research of the Group

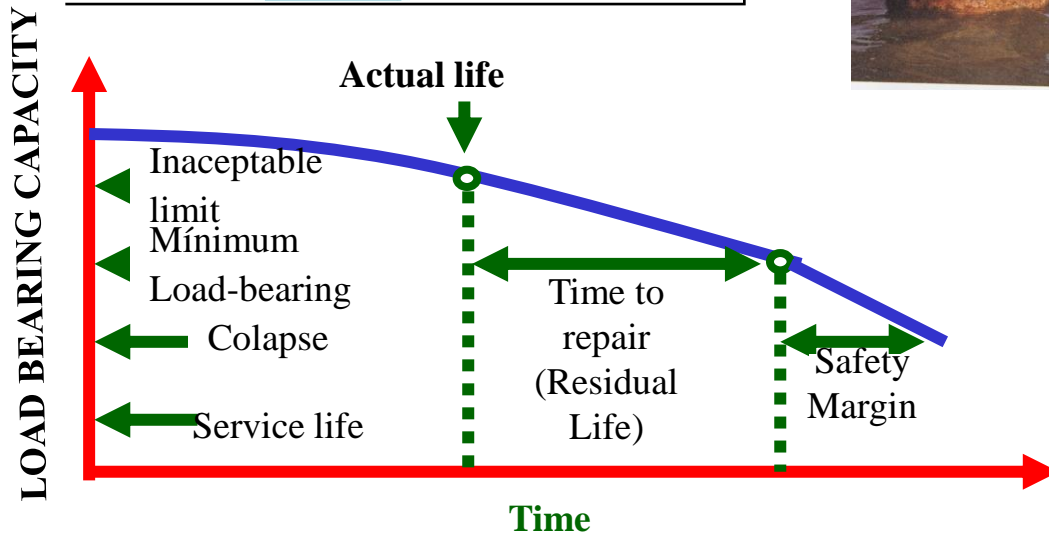
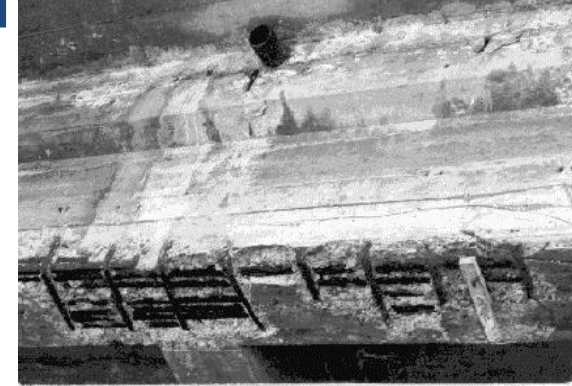
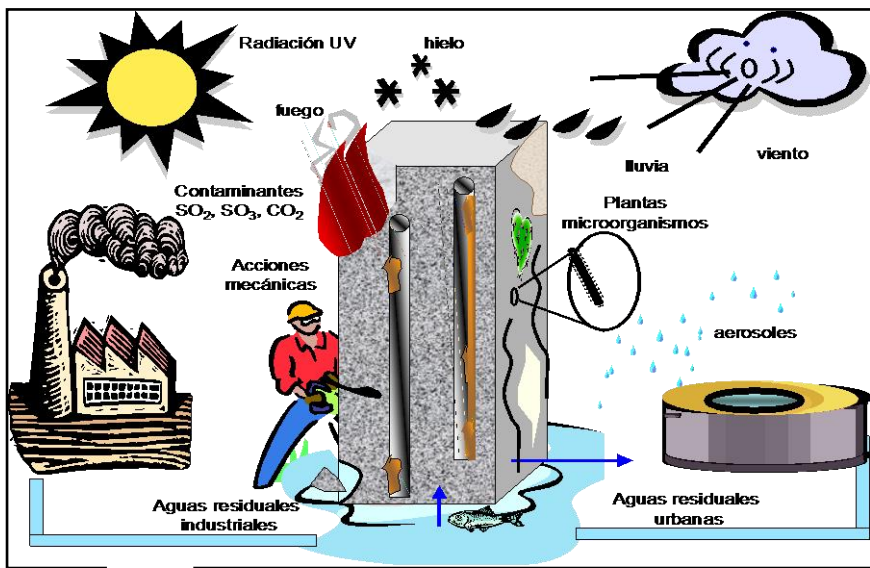
CORROSION AND STRUCTURAL SAFETY GROUP

thematic research goals

- Metallic **Corrosion** mechanisms and concrete **durability**
- **Non destructive techniques** for measuring corrosion
- Service life control through embedded **sensors**
- Reinforcement **protection** methods: stainless steel, galvanized rebars, inhibitors
- Rehabilitation and **repair** techniques
- **Numerical** simulation
- **Service life modelling** and structural Safety evaluation



DESIGN OF CONCRETE AGAINST ENVIRONMENTAL IMPACT SAFETY EVALUATION



Inspection techniques

Developers of the Corrosion rate meter GECOR

- **I_{corr}: Corrosion rate $\mu\text{A}/\text{cm}^2$.**
- **E_{corr}: Corrosion Potential (mV).**
- **Resistivity ($\text{k}\Omega\cdot\text{cm}$).**



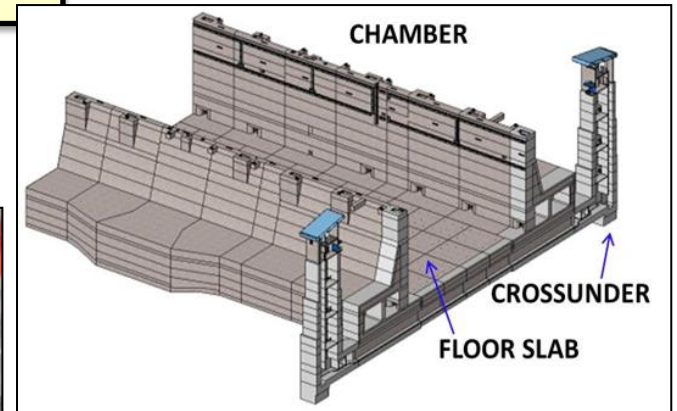
DEIGN OF DURABLE CONCRETE: Panamá canal

EVALUATION OF EXISTING STRUCTURES: Maracanã Stadium

Gatun Lake



Atlantic Approach Channel



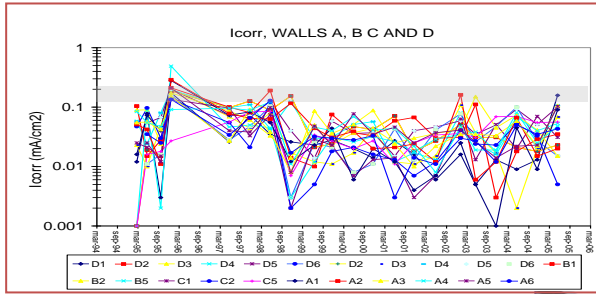
Colaboration with Enresa-Spain from 1987
with Ondraf-Belgium from 2011

El Cabril-Cordoba disposal of m&lrw

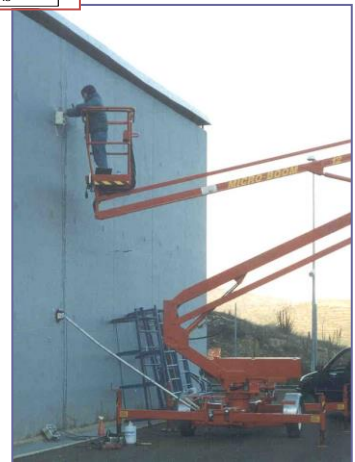
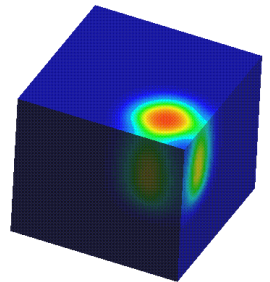
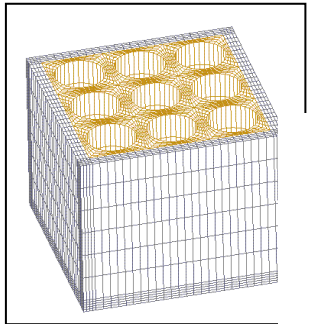


Composition of concrete and mortar.

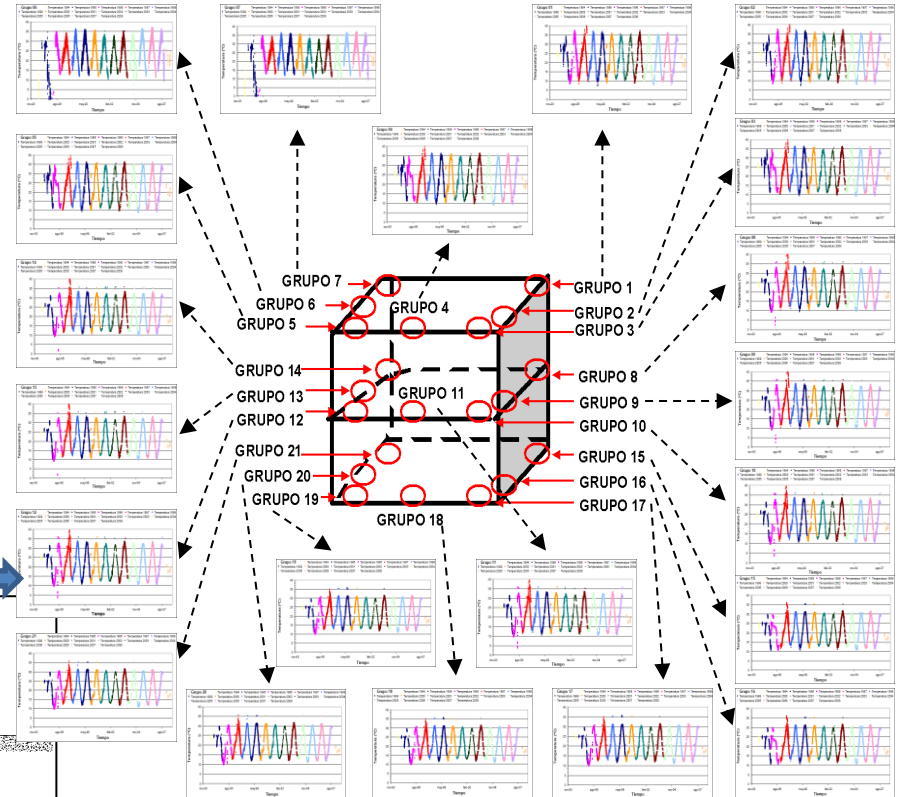
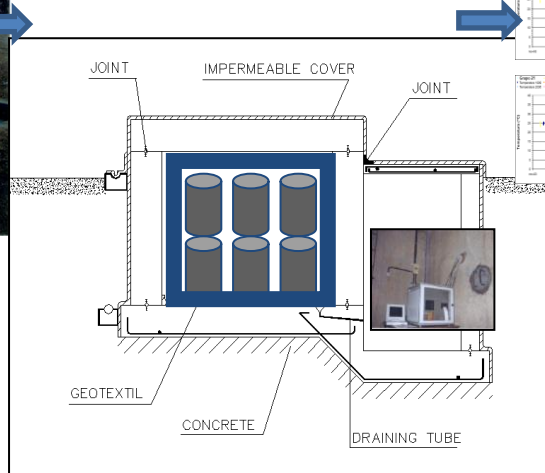
	Concrete	Mortar
Cement I-42.5 R/SR	400	-----
Cement IV-B-32.5 SR/BC	-----	708.3
Sand (0-2.5 mm)	297	-----
Sand (0-5 mm)	614	-----
Sand "ASIROSA"	-----	1239.4
Aggregate (6-16 mm)	949	-----
Superplastifier Melcret 222	4.8 (l)	-----
Admixture Rheobuild 1000	-----	7 (l)
w/c Ratio	0.45	0.37
w/(c+blending agents) Ratio	0.45	-----



Designing
Modelling
Monitoring



PILOT CONTAINER FOR THE MONITORING OF CONCRETE IN BURIED CONDITIONS



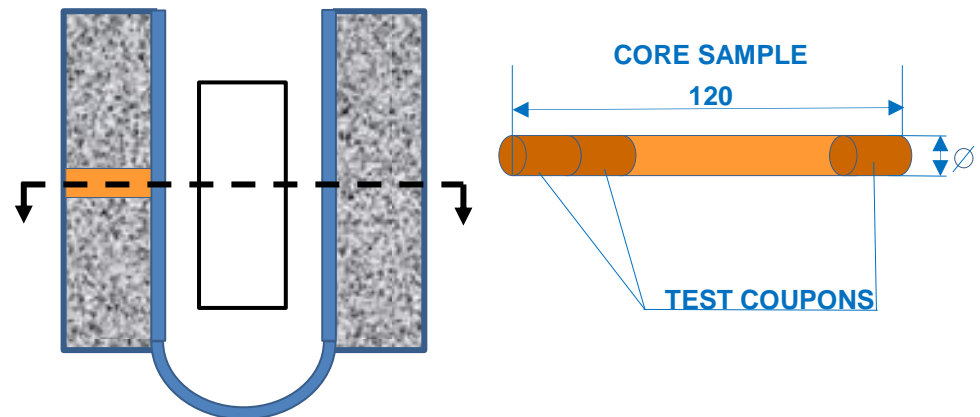
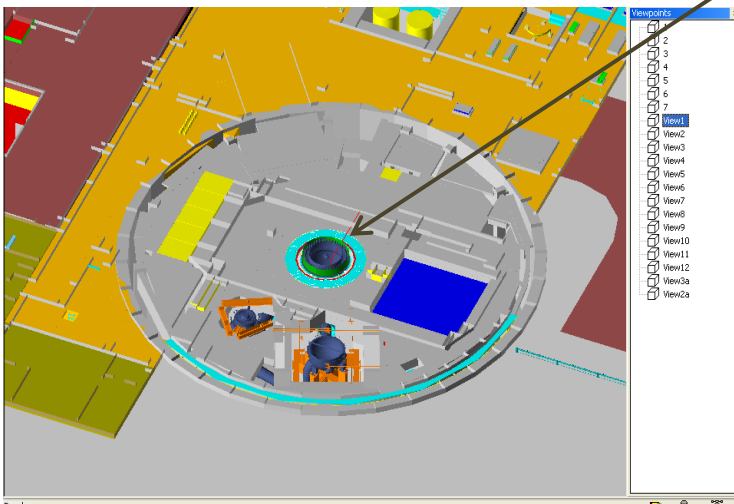
ASSESSMENT OF THE CONCRETE CONDITION IN “JOSE CABRERA” NUCLEAR POWER STATION AFTER DISMANTELING



- It was commissioned in 1968, and it operated until 2006

- On february 2010, ENRESA took the responsibility for decommissioning the station

Biological shielding. Core samples (irradiated):



THANKS FOR YOUR ATTENTION

